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A REPORT ON TELEVISION IN ARMY TRAINING--EVALUATION OF "INTENSIVE" TELEVISION FOR TEACHING BASIC ELECTRICITY.

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TO TEST THE ASSUMPTION THAT LEARNING EFFECTIVENESS VIA TV MIGHT DECLINE DUE TO LENGTHY VIEWING TIME AND FATIGUE, THIS STUDY COMPARED EFFECTS OF 38 HOURS OF CONTINUOUS TV TRAINING IN 5 DAYS WITH REGULAR CLASSROOM INSTRUCTION OVER THE SAME PERIOD. EFFECTIVENESS OF THE MINIMAL TV PRESENTATIONS THAT TRANSMIT EXISTING CLASSROOM INSTRUCTION WITH NO SCRIPTS, PROMPTING DEVICES, OR SPECIAL TV AIDS WAS ALSO EVALUATED. TV INSTRUCTOR QUALIFICATIONS WERE STUDIED. OF 8 GROUPS OF 281 TRAINEES IN THE POWERMAN'S ELECTRICAL MAINTENANCE COURSE, 4 RECEIVED TV INSTRUCTION AND 4 REGULAR INSTRUCTION. THERE WERE NO CONSISTENT DIFFERENCES IN TEACHING EFFECTIVENESS OF THE 2 METHODS. ON 10 IMMEDIATE POST-TESTS, REGULAR INSTRUCTION WAS SIGNIFICANTLY MORE EFFECTIVE THAN TV INSTRUCTION, BUT ON RETENTION TESTS 1 MONTH LATER, TV WAS JUST AS EFFECTIVE AS REGULAR METHODS. APTITUDE LEVEL, RATHER THAN INSTRUCTIONAL MEDIUM, WAS THE BETTER PREDICTOR OF TEST PERFORMANCE. MINIMAL TV IS RECOMMENDED FOR USE DURING EMERGENCIES OR FOR NEW MILITARY TV TRAINING PROGRAMS. DATA ARE REPORTED IN TABLES SHOWING STATISTICAL SIGNIFICANCE LEVELS BASED ON ANALYSIS OF OF VARIANCE AND T-TESTS. (LH)

A REPORT ON TELEVISION IN ARMY TRAINING

Evaluation of "Intensive" Television for Teaching Basic Electricity

- by Joseph H. Kanner
Sanford Katz
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Department of the Army
Office of the Chief Signal Officer

3 January 1958

This report has been prepared under the joint efforts of the Audio-Visual Applications Office, Army Pictorial Service Division, Washington 25, D. C., and the Television Division, Army Pictorial Center, Long Island City, N. Y., and is published for the information and guidance of all concerned. The report is a compilation of the results of studies conducted at Fort Gordon, Georgia, to demonstrate methods of implementing television techniques in standard classroom instruction and to evaluate their effectiveness for standard classroom instruction.

Acknowledgements

Appreciation is expressed to Brigadier General Ralph T. Nelson, Commanding General, U. S. Army Signal Training Center, Fort Gordon, Georgia, for the cooperation and support given to this study. Personnel of the Television Branch and the Test and Evaluation Branch of U. S. Army Southeastern Signal School at Fort Gordon gave generously of their time and effort in meeting many of the difficult administrative and testing requirements. Support and encouragement were also received from the Combat Development and Operations Division, OCSigO, and particular appreciation is expressed to General Kenneth Zitzman, Colonel Charles Burch, Colonel Morton Rubin, and Mr. Harry Siegal. Colonel W. W. Lindsay, Chief, Army Pictorial Service Division, OCSigO, has for many years encouraged and supported Signal Corps research. Lt Colonel Norman Gray and Major Hugh C. Oppenheimer participated in the development of the Signal Corps television research program and gave it the staff support necessary for its fulfillment. Colonel Arthur A. McCrary, Commanding Officer, Army Pictorial Center, played a vital role in carrying out the present study by his encouragement and support in research personnel, equipment, and other factors necessary for the study.

Research Personnel

This study stems from a program developed by Dr. Joseph H. Kanner, Chief, Audio-Visual Applications Office, Army Pictorial Service Division, OCSigO, and Drs. Richard P. Runyon and Otello Desiderato, formerly with the Applications-Development Section, Television Division, Army Pictorial Center. The study was conducted by SP-3 Sanford Katz, Ph.D., and SP-3 Peter Goldsmith, TV Applications Section, Television Division, Army Pictorial Center. At the U. S. Army Signal Training Center, Fort Gordon, Georgia, cooperation and assistance during various critical phases in the conduct of the study were received from Captain Steven Chomos, Mr. Joseph Jordan, Mr. Thomas Chandler and Mr. Steven Duboski, Testing and Evaluation Branch, The Southeastern Signal School.

Preface

THE SIGNAL CORPS TELEVISION RESEARCH PROGRAM

The present study is one of a series stemming from a joint Signal Corps research program. The program represents a coordinated effort by the Army Pictorial Service Division, the Combat Development and Operations Division, OCSigO, the Army Pictorial Center, and the Signal Schools at Fort Gordon, Georgia and Fort Monmouth, New Jersey. In August 1955, representatives of these organizations developed a long range program of research, designating critical areas of informational needs (13). Underlying this research program were two basic information targets. The first of these was the potential role and application of television during periods of emergency or mobilization. A previous study (7) had already indicated television's ability to teach a variety of military subject matters at least as well as conventional classroom instruction. This teaching equivalence, combined with television's ability to reach large or scattered groups of trainees, pointed out an important potential military use for television as a training and informational medium both in emergency and routine requirements.

It was also apparent that more information was needed concerning the effective uses of television for every day military training. Of immediate interest were such questions as instructor requirements for television teaching, television cost factors, intensive television instruction and reduction of teaching time.

Two studies were planned whose results would cut across many of the above areas of interest. The first, described in this report, was designed to evaluate the effects of "intensive" television teaching. Previous uses of television teaching have been limited to one or two hours a day*. There was an interest in the possible use of television for much longer periods of instruction. Such use, if possible, showed promise of reducing training costs when combined with television's potential for teaching large groups and using less expensive training aids. Related to this intensive use of television for teaching was a need for information on production problems for the continuous presentation of television instruction. The second study essentially was a continuation of the first, using the same subject matter. Its purpose was to attempt reductions in training time with television techniques, to further investigate television instructor requirements, to test the effectiveness of filmed instruction and to determine cost savings permitted by television instruction.

* i.e., one or two hours per day for a particular subject.

REPORT SUMMARY

Background

Numerous studies have already established that television can teach at least as well as regular classroom instruction in a variety of subjects. In these studies, relatively short segments of television and classroom instruction were used and they did not explore teaching by television over extended periods of time. At present, it has been determined that television may effectively teach a particular subject for a period of one or two hours a day. This abbreviated concept of presentation is in contrast to conventional classroom methods of instruction where subject matter is presented over extended periods of weeks or months. Were it possible to instruct by television over the same periods of time, more effective use of this instructional medium could be made during times of national emergency or in every day military training. One instructor could teach thousands of students via the television receiver and almost any building or room could be quickly converted into a classroom. The untested assumption that effectiveness of learning might decline very rapidly because of lengthy viewing time, fatigue, or similar factors, has retarded the use of television for more extended periods of instruction.

In addition to the primary aim of testing this assumption, there was an interest in evaluating certain rapid television presentation methods. These methods, labeled as "minimal" television, employ television to transmit existing classroom instruction, with no effort to use scripts, prompting devices, aids or specific television instructor training. Instruction by "minimal" television has the advantage of requiring less time and cost in preparation than instruction which has been specifically designed to utilize available studio, camera and teaching techniques. These economies in time and money may satisfy a critical need during periods of emergency. For everyday training needs, "minimal" television provides low-cost, rapid instruction. Prior to any recommendation for its use, however, the teaching effectiveness of "minimal" television would have to be compared with conventional classroom instruction. Advantages and disadvantages of "minimal" television are presented in Appendix I.

Purpose

It was the purpose of this study to compare the effect upon learning produced by 38 hours of continuous television training over a five day period, with that produced by a similar period of regular classroom instruction. A secondary objective was to evaluate the teaching effectiveness of "minimal" television presentations. Thirdly, the study evaluated the preparation and training requirement needed to qualify personnel for teaching extensive segments of subject matter over television.

Method

Trainees at the United States Army Signal Training Center, Fort Gordon, Georgia, entering the first week of the Powerman's Course.

(MOS 351), were taught either by television or in the regular classroom. Groups trained under either condition received ten written tests for the five days (38 hours) of instruction. The results of these tests served as the basis for comparison between television and classroom trained students. In addition, a retention test was given to both groups about one month later. The same materials and instructors were used in the television and classroom instruction and no attempt was made to modify classroom instruction for television presentation.

Results

There were no consistent differences in teaching effectiveness between television and regular instruction.

Regular instruction was more effective than "minimal" television instruction on immediate test scores.

Television instruction was as effective as regular instruction on retention test scores.

Aptitude level, rather than instructional medium, proved to be the important determiner of test performance.

Conclusions

Using instruction similar to that employed in this study, television training may be extended to at least five days (38 hours) without any greater decline in learning than that produced by regular classroom instruction.

While the immediate learning produced by "minimal" television teaching may fall below classroom or improved television instruction, it is remembered at least as well. For most types of military instruction, retention and application of information at a later date is the more important criterion. The sole use of "minimal" television, however, may hinder development of more effective television teaching methods.

Because of its low cost and time saving features, "minimal" television is recommended for use during emergency periods or for military installations just beginning a television training program. For such installations, the use of "minimal" television methods provides a rapid, inexpensive means of disseminating large segments of military instruction. In addition, it also provides valuable initial experience in the use of television for training.

To achieve improvements in television teaching, and to make full use of television's presentational features, "minimal" television procedures should be followed by procedures to adapt television techniques to subject matter.

The study's evidence on the important role of aptitude in learning points to the recommendation that improvements in trainee selection procedures would facilitate training problems in the Powerman's Course.

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Chapter 1

STATEMENT OF PROBLEM AND RESEARCH METHOD

The present report is based on an experimental study carried out at the U. S. Army Signal Training Center, Fort Gordon, Georgia, from January to April 1956. The study is one of a series designed to explore and develop the use of television for military training purposes.

Background

Previous studies have established that television can teach at least as well as conventional classroom methods (1, 3, 5, 7, 10, 11). This factor of teaching equivalence, therefore, was not a primary concern of the present study. The main interest lay in further developing the use of the television medium itself for military training. One area of development considered of importance was the possibility of using television more intensively. Generally, television instruction for any one subject matter has been limited to one or two hours a day. While six to eight hours a day may be devoted to television instruction, for example, at Fort Gordon, this would be spread among as many different subject matters and groups of trainees. There was no recorded instance of using television to teach one subject matter for an entire day, extending over several days, as typical of conventional classroom instruction in many military subject matters. The advantages of using television for military instruction would be amplified were such intensive use possible. During emergency or mobilization periods, the ability to use television intensively to teach large segments of instruction would prove a valuable if not mandatory means of communication and training.

Purpose

A major objective of the study was to determine whether television could be used to teach large segments of military instruction without impairing teaching effectiveness. A subsidiary objective was to evaluate production techniques associated with the type of television training employed in this study so as to provide guidelines for future use of the medium.

The Possible Effects of the Intensive Use of Television

Continuous exposure to any method of instruction is probably accompanied by a progressive decline in learning efficiency, with the degree of decline depending upon method of instruction and type of subject matter. In this study, the objective was to determine the degree and nature of this decline for television as compared with regular classroom instruction, using the subject matter contained in the Powerman's Course.

Subject Matter

The first week of the Powerman's Electrical Maintenance Course (MOS 351) at the Signal School, Fort Gordon, was selected for use in the

study. The purpose of the Powerman's Course is to train selected enlisted personnel to install, operate, and perform organizational maintenance of portable electric-power generating equipment. Essential to the successful performance of their mission is a thorough grasp of the fundamentals of electricity as related to their jobs. For example, a Powerman would have to know not only the principles of magnetism and their relation to electricity but also how to change a battery as well.

The first week of the course is chiefly concerned with the principles of electricity and covers such subjects as first aid, electricity, magnetism, test equipment, Ohm's Law, parallel and series circuits, the reading of diagrams, grounds, electro-magnetism, induction, transformers, storage batteries, the RA-91 rectifier, the charging of storage batteries, and maintenance records. The instruction, as normally presented, included lectures, a number of training films, and practical exercises in which the student had an opportunity to apply what was learned in the lectures. This portion of the Powerman's Course is very typical of a variety of electronics courses and training given in the Army.

Trainees

The trainees were 281 enlisted men assigned to the Powerman's Electrical Maintenance Course (MOS 351) at The Southeastern Signal School, Fort Gordon, Georgia. Information, including the aptitude test scores of the trainees, was supplied by the School's Record Branch. Trainees were not informed of the fact that they were participating in an experiment. Fort Gordon has been using television for training for about six years, and television instruction is not considered a novel method of teaching.

General Design

Trainees entering the first week of the Powerman's Course received instructions exclusively by television or by regular classroom methods. Table 1 indicates the rotation of television and regular instruction used in this study.

TABLE 1

Alternation of Television and Regular Instruction Methods*

Week	Method	Week	Method
1st	Regular	5th	TV
2nd	TV	6th	TV
3rd	TV	7th	Regular
4th	Regular	8th	Regular

*It was originally planned to have an ABBAABBA order to control for possible systematic week-to-week variations, but, due to reasons beyond the experimenters' control, the order had to be changed.

The instruction was the same for all groups. It was divided into 10 sessions, 5 morning and 5 afternoon periods, with tests administered at the end of the morning and afternoon sessions to measure immediate learning. A retention test was administered about one month after the end of the first week of instruction.

This design permits a comparison of the teaching effectiveness of television and regular classroom instruction after various amounts of viewing time. It is most likely that the rate of trainee learning declines as the amount of instruction increases in both television and regular classroom instruction. The purpose of this study is to determine whether the rate of decline differs for the two teaching procedures. For example, is learning more impaired by intensive television instruction as compared with intensive regular classroom instruction? Trainee performance on the 10 tests used would provide evidence on this question. Such evidence would be in the form of a systematic rate of change in test scores favoring one method over the other.

Figure 1 indicates a few of the many possible outcomes of the study. Graph (a) exemplifies an outcome indicating that increased viewing time increases the differences between media (shaded area). Graph (b) exemplifies an outcome indicating that increased viewing time decreases differences between media (shaded area). Graph (c) exemplifies an outcome indicating that the differences between media are not affected by increased viewing time.

It must be stated at the outset that the design is not very sensitive to small differences in losses in teaching effectiveness. This fact does not decrease the value of the experiment to any great extent, since a small change in differential teaching effectiveness would not be of any great consequence. Conversely, any increase in the sensitivity of the experiment would have required an extremely large increase in expenditures of man-hours and money.*

* For further discussion of the experimental design, see Appendix A.

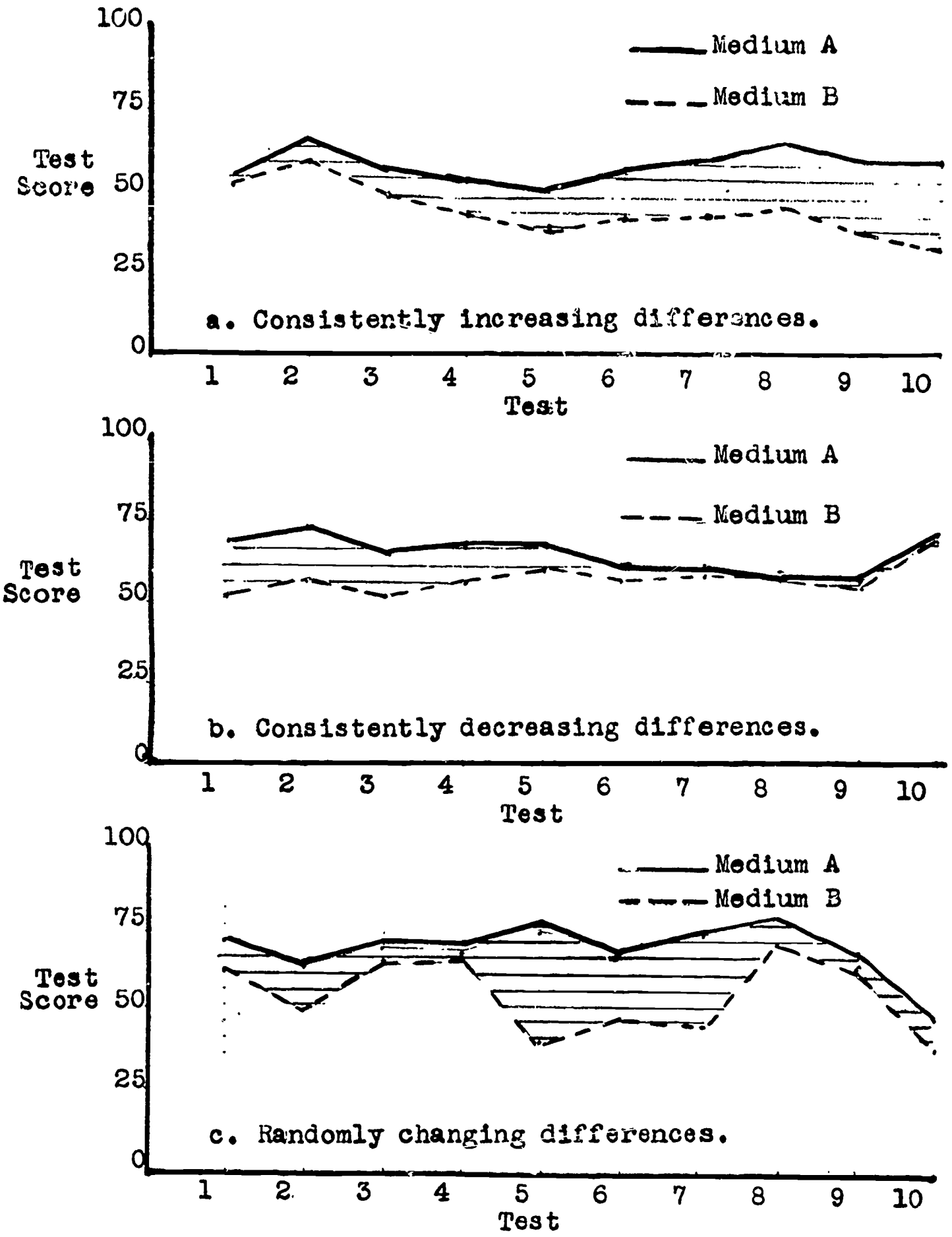

Figure 1. Hypothetical results indicating possible outcomes of the study.

Chapter 2

PREPARATION OF TESTS AND INSTRUCTION

Immediate Testing

Evaluation was based on the results of written tests given to the trainees immediately after instruction. Since it is not generally Army procedure to give immediate tests, a series of ten tests were developed for the study, containing a total of 296 items. The items were 4-alternative multiple choice and were constructed with a view to making them easily understood and unambiguous. An attempt was made to have items of varying difficulty, with the average difficulty being high enough above chance to avoid the floor effect* and low enough to avoid the ceiling effect*. Wherever possible, items employing pictures or diagrams were used.** The ten tests were tried out on three regular instruction classes. Items that were too difficult or too easy and items that were poor discriminators,*** were either revised or dropped.

The tests were partly mimeographed and partly zeroxed. The test instruction sheet was that employed by the Test and Evaluation Branch at The Southeastern Signal School. The answer sheet was the Army Standard Answer Sheet for scoring with IBM machines. A test was administered at the end of the morning and afternoon instruction over a five day period. Students were instructed to answer all questions even if they had to guess. Figure 2 shows trainees during a test administration period.

Retention Tests

The format of the Powerman's Course offered a rare opportunity to administer retention tests about one month after the one week segment used in this study. Normally, after this one week is taught, trainees are given instruction in diesel and gasoline engine operation and similar materials generally unrelated to the first week's electronics instruction. This instruction continues for about one month and then the students return to electronics instruction. The instructors, therefore, are more

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* Differences between groups are minimized or eliminated when test items are so difficult that few trainees are able to answer them correctly (the floor effect), or so easy that most trainees are able to answer them correctly (the ceiling effect).

** See Appendix B for examples of test items.

*** The discriminative power of a test item is determined by dividing the trainees into two groups on the basis of score on the test as a whole: high scorers (above the 50th percentile) and low scorers (below the 50th percentile) any test item which is answered correctly by about as many low scorers as high scorers is considered to have poor discriminative powers.

concerned with what the students have retained from the electronics instruction given the previous month than in any immediate learning. This condition also approximates Army instructional requirements because several weeks or months generally intervene between completion of formal training and on-the-job activity.

The retention test administered in this study consisted of 70 representative test items selected from the 10 tests given during the first week of instruction. This test was administered to the trainees about one month after the first week's instruction had been completed and prior to the beginning of further electronics instruction in the course.

PREPARATION OF INSTRUCTION

The Instructors

Four instructors divided the teaching load. All four were members of the course staff and had taught some of the material before the experiment. The work load was divided so that each instructor taught at least one but no more than 2 hours on each of the 5 days of instruction. They taught the same hours on TV as they did on regular instruction. None of the instructors had TV teaching experience prior to this study.

Teaching Materials

In regular classroom instruction, the instructor follows a lesson plan outline which indicates key items of information to be covered. This procedure permits wide variations in the instructor's presentation although he may cover the lesson plan objectives. The same procedure was used in the television presentations, with the instructors following lesson outlines rather than a detailed script.

Training Aids

The same training aids were used in both the television and regular instruction with the exception that wherever possible actual equipment instead of mockups were used in the television presentations. The training films employed were presented by projector and screen in the regular instruction and over the television receiver in television instruction. The blackboard was used frequently in both methods of instruction.

Rehearsals

Each hour was rehearsed at least once, with attention being paid to movements in front of the cameras, writing on the blackboard, the handling of training aids in front of the cameras, and other of the details required for a television presentation. The television directors were given copies of the lesson plans in which they made notes as to the presentation, and which served as their guide.

Figure 2. Trainees in the Powerman's Course taking a test after instruction at the Southeastern Signal School.

Figure 3. Trainees receiving television instruction in the Powerman's course during the experimental study at the Southeastern Signal School, Fort Gordon, Ga.

Chapter 3

DESCRIPTION OF EXPERIMENTAL PROCEDURE

Description of Instruction

Training Site

Both television and regular instruction were presented in the classrooms normally used for instruction in the Powerman's Course. For television instruction, two 21" receivers were used in the classroom. (See Figure 3.) In regular instruction, the instructor spoke from a rostrum in front of the class. (See Figure 4.) The size of the classes was never greater than 45. Practical exercises took place in a room with a number of tables on which the equipment used could be laid out (See Figure 5).

Regular Instruction

Normal teaching procedures were followed in regular instruction. An attempt, not always successful, was made to eliminate questions and answers so as to achieve comparability with the television presentations.

Television Instruction

The staff used in the TV production included a program director, a technical director, an audio man, 2 cameraman and a prop man. Two DuMont cameras were used for each presentation, with lenses varying in focal length from 2" to 8". Two studios were employed in a single alternation series in order that each studio could be set up for the following presentation. The presentation was transmitted over a closed-circuit via coaxial cable. No intercommunication system was used between the classroom and instructor, so that the class could not ask or answer questions. Little or no attempt was made to adapt the regular instruction to television requirements. Special effects, superimposures, closeups and similar techniques were eliminated or employed minimally. The instructor appeared before the cameras and gave his presentation from an outline in the same manner as in the regular classroom instruction.

Visual Aids

Due to the theoretical nature of much of the material covered, relatively few visual aids were employed. The aids that were employed included some test equipment, the RA-91 rectifier, maintenance record forms, transformer demonstration equipment, and a few others. (See Figure 6 for an example of a training aid employed in the study.) The blackboard was used very frequently. A demonstration of artificial respiration techniques was presented. Superimposures were used in only a few instances and no split screen equipment was available. In general, it could be stated that the production for the major part was of the lecture variety with some demonstrations of structure and function of equipment. (See Fig. 7 for instruction as it emanated from TV studio).

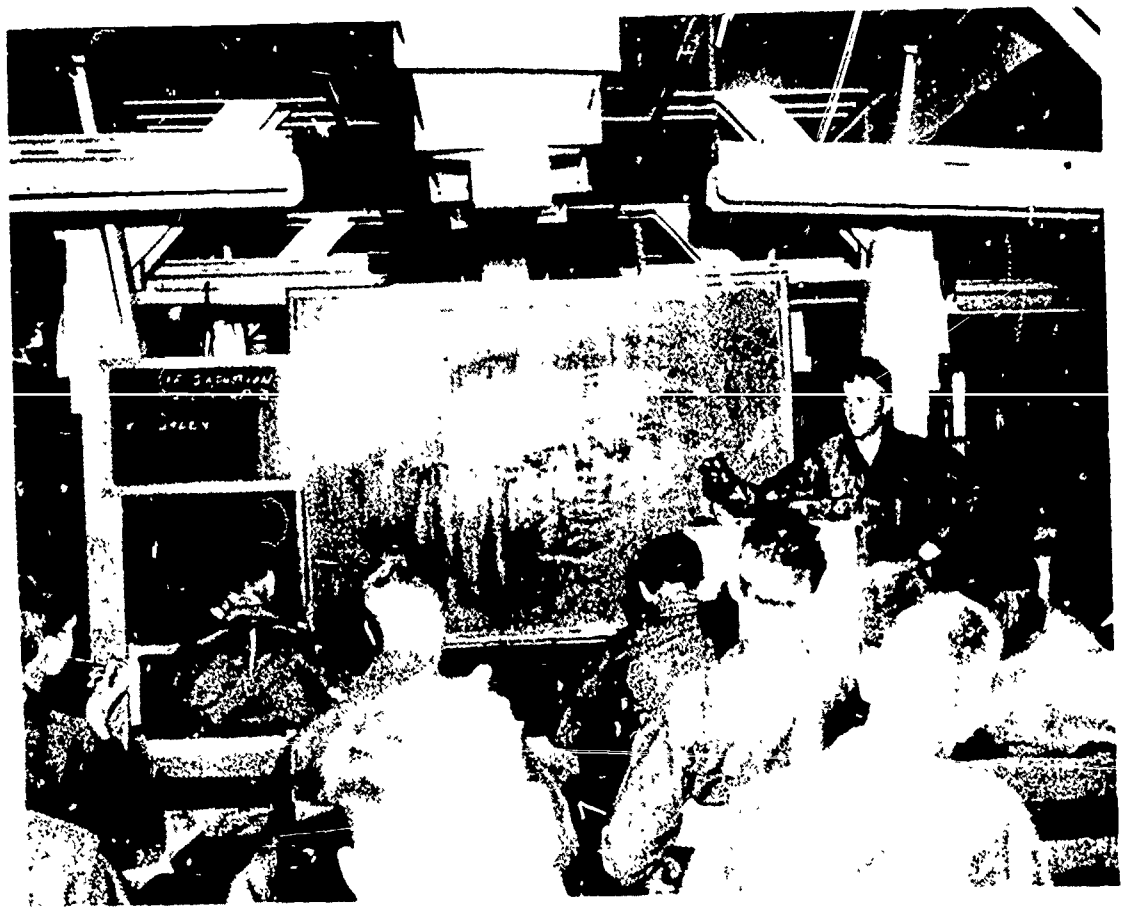

Figure 4. Regular classroom instruction during the experimental study at the Southeastern Signal School, Fort Gordon, Ga.

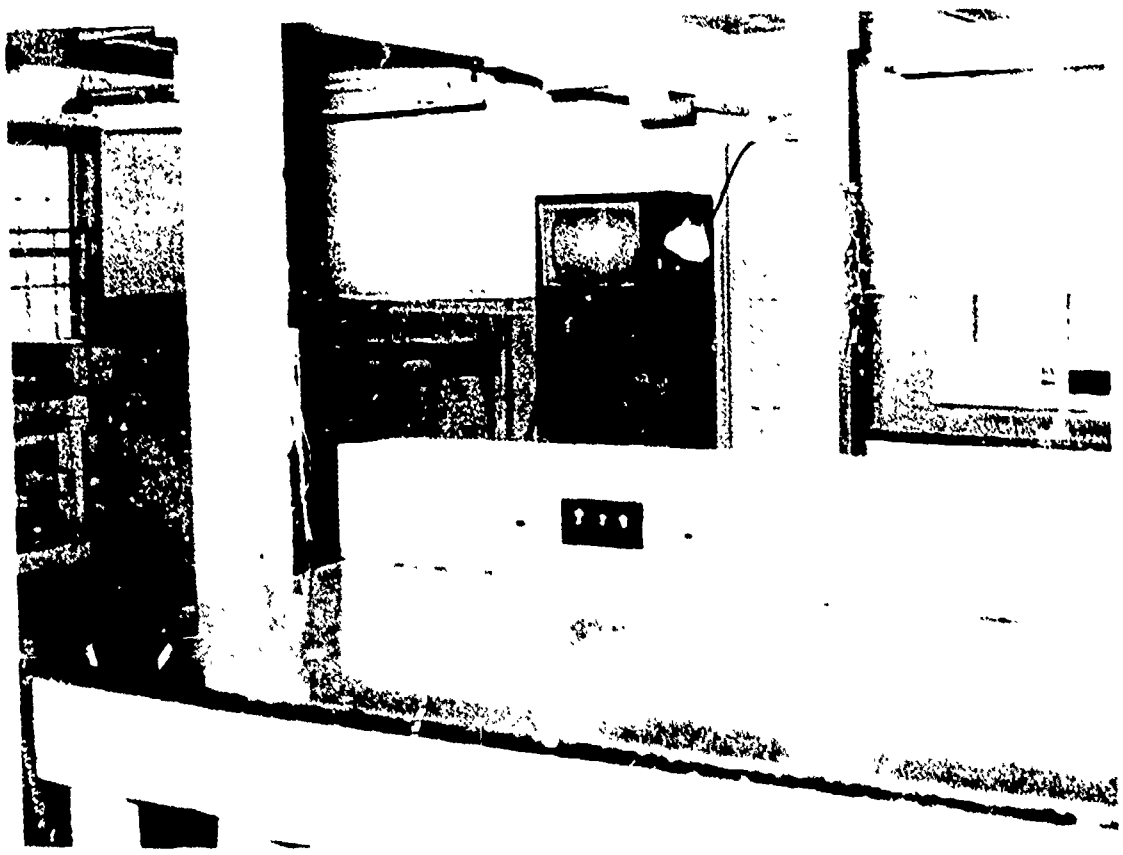

Figure 5. Classroom employed for practical exercises in the experimental study.

Figure 6. Mock-up of the D'Arsonval movement employed in test equipment: An example of a training aid employed in both regular classroom and TV instruction.

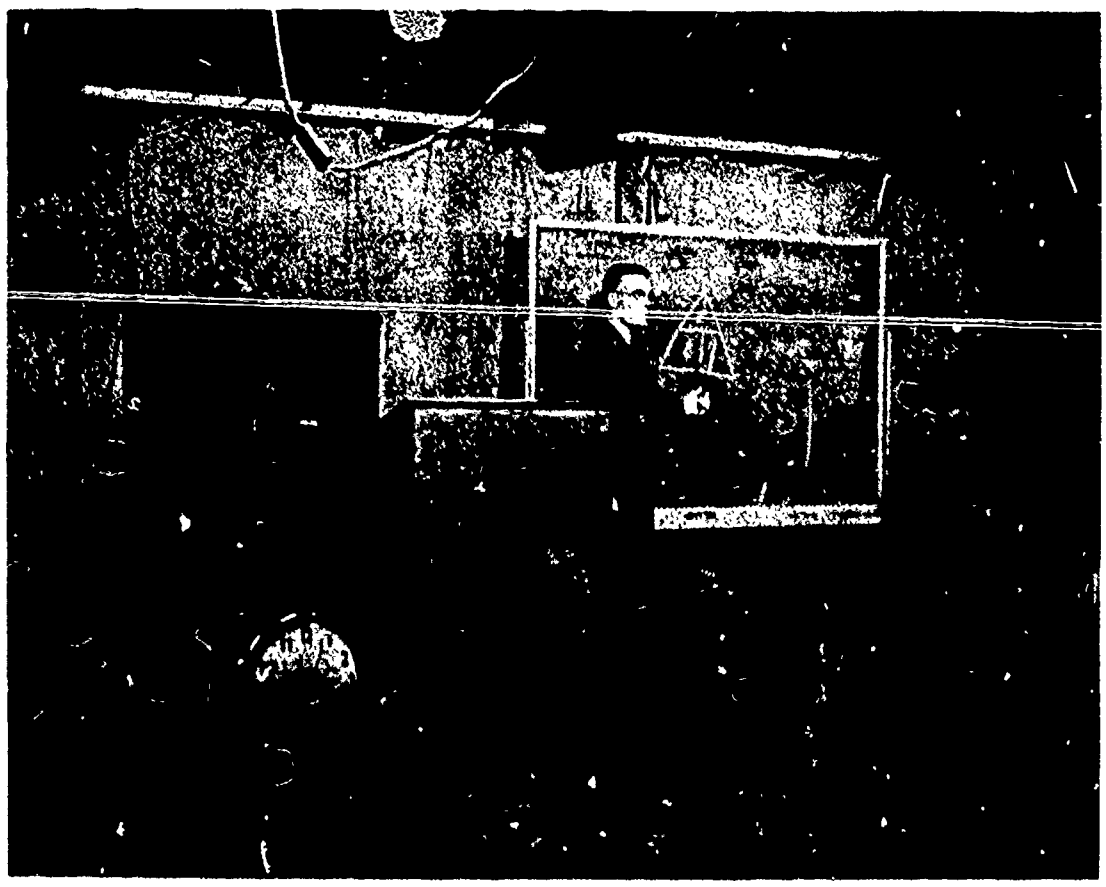

Figure 7. Instruction as it originated from the TV studio.

Auditing of Instruction

Both the regular and TV instruction were monitored in order to determine what actually went on the classroom and to see if the material was covered. The monitor sat in the classroom with a check list based on the lesson plans. He used the check list to indicate whether or not the material was actually covered.

Proctors were provided by the Test and Evaluation Branch in order to keep discipline during the TV presentation.

INSTRUCTION SCHEDULE

Appendix C presents the instruction schedule for each week. It includes the subject matter; the format of the instruction, i.e., whether conference, demonstration, training film, or practical exercise; the instructor (indicated only by letters); the times; and the test schedule. This schedule was repeated for 8 consecutive weeks with 8 different groups. Four presentations were by TV, the other four were regular instruction sessions.

Chapter 4

ANALYSIS OF RESULTS

Treatment of Data

The answer sheets were scored by electronic scoring machines. Before scoring each answer sheet was checked for poor erasures and duplicate answers. Tally sheets provided a check on the scoring.

Post Selection and Post Matching of Trainees

Only trainees completing all 10 tests were considered in the analysis of results. In order to eliminate initial differences in aptitude, a post-matching procedure was employed based upon trainees aptitude test scores. Each trainee from the regular classroom group was paired with a trainee from the TV group who had an equivalent aptitude test score. The number of trainee pairs employed in the analysis were 62 for immediate testing and 50 for retention testing. For a more detailed description of the post-selection and post-matching procedures, see Appendix D.

Monitor's Reports

The monitor system employed in checking whether or not the instruction included the information required to answer the test questions was found to be inadequate. Therefore, no items were dropped from the tests.

Statistical Analysis of Data

The main statistical tests employed in evaluating the differences between the various treatment groups were analysis of variance and the t-test. Summaries of the statistical analyses are presented in the Appendix. Differences described as "significant at the 5% level of confidence", which is a commonly used standard, will be accepted as indications of "real" differences between the various groups. Differences not significant at the 5% level of confidence will be accepted as indications of no differences between the groups.

RESULTS

Immediate Testing

Table 2 presents the means for and difference between TV and regular instruction on the 10 tests, singly and combined (total score). These results indicate that regular instruction was slightly but consistently superior to TV instruction.

The trainees were divided into two aptitude level groups, with the top 31 pairs being treated as the high aptitude level group and the bottom 31 pairs being treated as the low aptitude level group. Table 3 includes the mean raw scores for the various combinations of aptitude-media groups on the various tests. Table 4 includes the same results as percentages of the number of items included in the various tests.

The high-level aptitude groups were consistently superior to the low-level aptitude groups regardless of method of instruction. This result indicates that aptitude was the more critical variable in determining learning and performance, and instruction medium was of lesser importance.*

TABLE 2

MEAN RAW SCORES FOR THE 10 TESTS

TEST	NO. ITEMS	REGULAR INSTRUCTION MEAN	TV INSTRUCTION MEAN	DIFFERENCE
1	37	23.3	21.2	2.1**
2	19	9.5	8.3	1.2**
3	38	22.1	19.6	2.5**
4	23	8.3	7.8	.5-
5	36	17.5	16.6	.9-
6	20	11.3	10.5	.8-
7	37	22.3	20.5	1.8**
8	23	10.8	10.0	.8-
9	38	22.3	19.2	3.1**
10	25	17.4	14.6	2.8**
TOTAL SCORE	296	164.7	148.5	16.2**

** Significant at the 5% level of confidence.

*See Appendix A for overall Analysis of Variance and Appendix F for Analyses of Variance of individual tests.

TABLE 3

MEAN RAW SCORES FOR MEDIA, APTITUDE LEVELS AND TESTS

Test	No. Items	Medium	Aptitude Level High	Aptitude Level Low
I	37	Regular	26.8	19.8
		TV	23.4	19.0
		Combined	25.1	19.4
II	19	Regular	10.7	8.3
		TV	9.5	7.2
		Combined	10.1	7.8
III	38	Regular	25.4	18.7
		TV	22.5	16.7
		Combined	24.0	17.7
IV	23	Regular	9.4	7.3
		TV	9.1	6.6
		Combined	9.2	7.0
V	36	Regular	20.5	14.2
		TV	18.6	14.7
		Combined	19.6	14.4
VI	20	Regular	12.0	10.6
		TV	11.6	9.5
		Combined	11.8	10.0
VII	37	Regular	24.5	20.1
		TV	23.0	18.1
		Combined	23.8	19.1
VIII	23	Regular	11.7	9.8
		TV	11.0	9.1
		Combined	11.4	9.4
IX	38	Regular	25.7	18.9
		TV	22.4	16.0
		Combined	24.0	17.4
X	25	Regular	18.8	16.0
		TV	16.2	13.1
		Combined	17.5	14.6
TOTAL	296	Regular	185.6	143.7
		TV	167.3	130.0
		Combined	176.5	136.8

TABLE 4

MEAN % SCORES FOR MEDIA, APTITUDE LEVELS AND TESTS

TEST	No. ITEMS	MEDIUM	APTITUDE LEVEL HIGH	LOW	COMBINED	DIFF REG - TV
1	37	Regular	72.4	53.5	63.0	5.7
		TV	63.3	51.4	57.3	
		Combined	67.8	52.4	60.0	
2	19	Regular	56.3	43.7	50.0	
		TV	50.0	37.9	44.2	5.8
		Combined	53.2	41.1	47.4	
3	38	Regular	66.9	49.2	57.9	
		TV	59.2	44.0	51.6	6.3
		Combined	63.2	46.6	54.7	
4	23	Regular	40.9	31.7	36.5	
		TV	39.6	28.7	33.9	2.6
		Combined	40.0	30.4	35.2	
5	36	Regular	56.9	39.4	48.3	
		TV	51.7	40.8	46.1	2.2
		Combined	54.4	40.0	47.2	
6	20	Regular	60.0	53.0	56.5	
		TV	58.0	47.5	53.0	3.5
		Combined	59.0	50.0	55.0	
7	37	Regular	66.2	54.3	60.3	
		TV	62.2	48.9	55.7	4.6
		Combined	64.3	51.6	57.8	
8	23	Regular	50.9	42.6	47.0	
		TV	47.8	39.6	43.5	3.5
		Combined	49.6	40.9	45.2	
9	38	Regular	67.6	49.7	58.7	
		TV	59.0	42.0	50.5	8.2
		Combined	63.2	45.8	54.5	
10	25	Regular	75.2	64.0	69.6	
		TV	64.8	52.4	58.4	11.2
		Combined	70.0	58.4	64.0	
TOTAL	296	Regular	62.7	48.6	55.7	
		TV	56.5	43.9	50.2	5.5
		Combined	59.7	46.2	52.9	

Retention Tests

In order to evaluate the retention test results, trainees' immediate scores on the 70 items used in the retention test are used as a base line. Table 5 presents the mean immediate and retention scores on the 70 items for the Regular Classroom and Television Instruction Groups.

The results for immediate testing indicate that the Regular Instruction Group was superior to the Television Instruction Group. However, the results for retention indicate that the Television Instruction Group retained as much as the Regular Instruction Group one month later.

TABLE 5

MEAN IMMEDIATE AND RETENTION TEST SCORES
ON THE 70-ITEM RETENTION TEST

	N	Regular Instruction	TV Instruction	Diff.
Immediate Score				
High Aptitude	28	50.9	46.1	4.8*
Low Aptitude	22	39.3	34.6	4.7
Combined	50	45.8	41.0	4.8*
Retention				
High Aptitude	28	44.6	43.5	1.1
Low Aptitude	22	37.1	33.9	3.2
Combined	50	41.3	39.3	2.0

* Significant at the 5% level of confidence.

Chapter 5

COMPARISON OF THE EFFECTS OF "INTENSIVE" EXPOSURE TO TELEVISION AND REGULAR CLASSROOM INSTRUCTION ON TRAINING EFFECTIVENESS

The major question to be answered in this study was whether the intensive use of television would produce a greater decline in learning than the intensive use of classroom instruction. Table 6, column 2, indicates the percentage of differences on the 10 tests between television and classroom instruction. Evidence for a greater rate of decrease in teaching effectiveness for one of the methods would be a consistent increase in the size of the differences with each succeeding test. Column 3, Table 6, ranks the tests according to the magnitude of the differences found. This ranking provides no evidence that intensive television per se is more detrimental to learning than regular classroom instruction.

The lack of a systematic trend can be seen from Figure 8, which presents the mean test scores on the 10 tests as percentages of total possible score for Regular instruction and Television instruction. The shaded area represents the change in the differences between media after varying amounts of exposure time (compare with Figure 1).

Because of the limited sensitivity of the experiment, it cannot be concluded that there is absolutely no difference between the two media in amount of loss in teaching effectiveness resulting from increased exposure time. It can be concluded, however, that the differences are at best relatively small, and of little importance.*

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*See Appendix H for further analysis of the intensive television results.

TABLE 6

PERCENTAGE DIFFERENCE AND RANK ORDER OF DIFFERENCE AS A FUNCTION OF TEST ORDER

1 Test Order	2 Difference in %	3 Rank Order of Difference
1	5.7	6
2	5.8	7
3	6.3	8
4	2.6	2
5	2.2	1
6	3.5	3.5
7	4.6	5
8	3.5	3.5
9	8.2	9
10	11.2	10

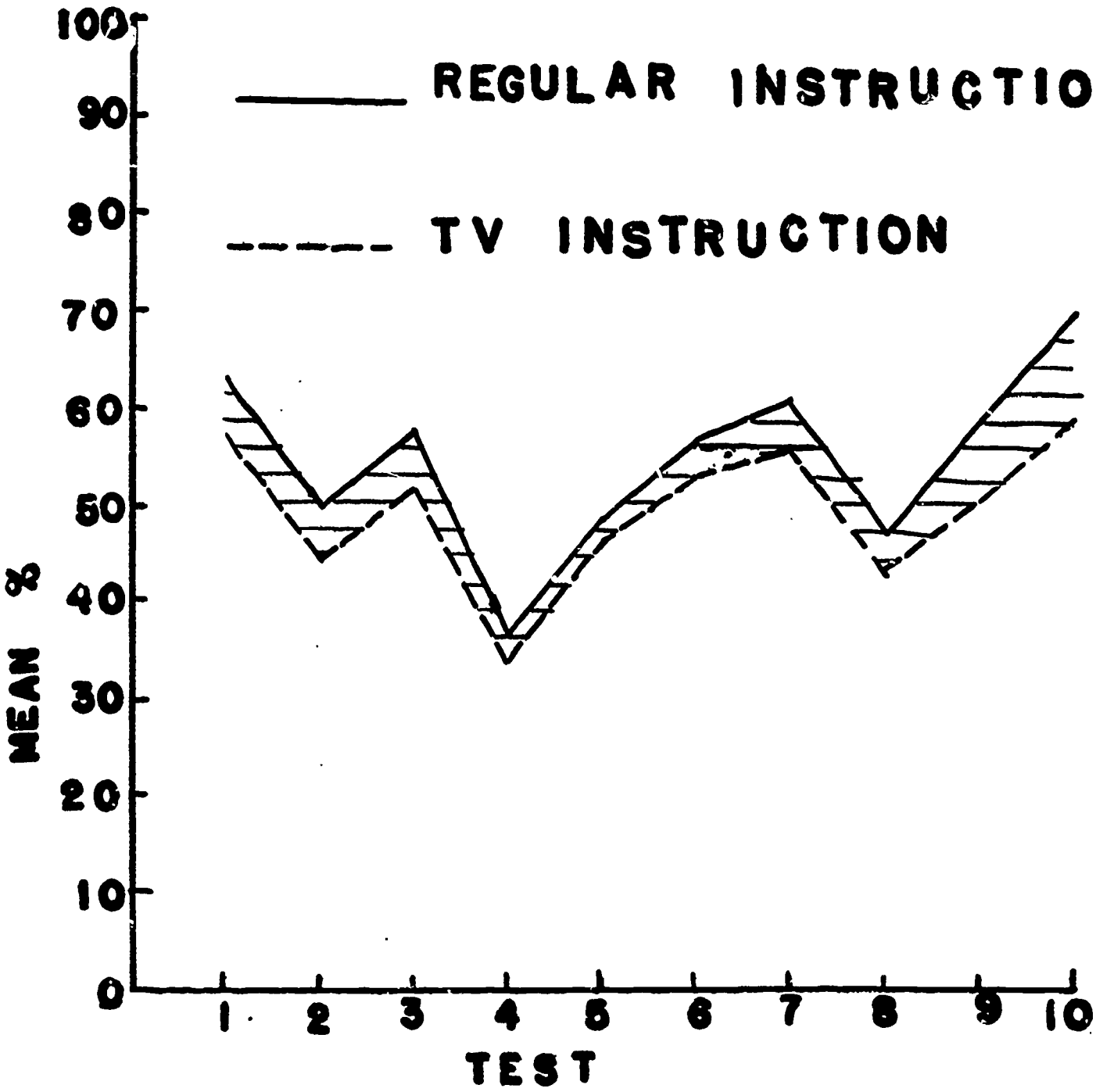

Figure 8. Test by test comparisons of regular and television instruction (compare with figure 1).

Chapter 6

TELEVISION versus REGULAR INSTRUCTION

TRAINING

Although this experiment was not designed to compare the overall effectiveness of Television instruction with Regular instruction, the question deserves consideration. The learning results of this experiment are inconsistent with the results of other experiments which indicate that television instruction can teach at least as effectively as regular instruction (1, 3, 5, 7, 10, 11). There were some marked differences between the television presentation of this experiment and those of prior experiments. These differences shall be considered.

The Nature of the Content

Previous studies have utilized content involving a great deal of visual material, e.g., map reading, assembly and disassembly of the light machinegun, etc. The material employed in the present study was for the most part of a theoretical nature and required little visual presentation. This difference may be of importance in that TV presentations with little visual material may be much less interesting than comparable regular instruction presentations. This may be related to the lack of face to face contact between instructor and student.

Scripts

The previous studies involved instruction presented from verbatim scripts; the instruction in the present study was based on outlines. Given a good script, the first procedure insures the same coverage of the material at all times. The use of an outline does not insure the same coverage at all times. There is less pressure on the instructor in the classroom than there is in the TV studio. The presentation over TV requires that the instructor look into the cameras, pay attention to cues from the floorman, watch the monitor, be careful when walking and when manipulating training aids; at the same time he must present his lecture. It is possible that the coverage of the material was better and more complete in the regular instruction situation than in the TV situation.

Another factor to be considered is the pacing of the presentation. In the regular classroom situation, the students can informally control the instructor's pace by means of gestures, questions, etc. The use of prompting equipment would also control the pace of the instructor to a certain extent. When an instructor employs an outline script in TV presentation, he must judge for himself how slow or how fast the material should be presented.

A third factor to be considered in the employment of outline scripts in TV presentations is the smoothness of the presentation. The directors, cameramen, floormen, etc., are less certain as to the sequence of events. They must follow the instructor and thus are liable to make mistakes.

Visual Aids

The presentation suffered from inadequate employment of visual aids. Because of time limitations, the bulk of the training aids were those employed in the classroom. These aids, while adequate for the classroom, were not made for TV. If these aids were made specifically for TV they would have been constructed differently. Not only were training aids different from what would normally be employed, but also, the visual advantages of TV were not exploited, e.g., use of split screen, superimposures, or bread boards.

Instructors

The instructors had never taught by way of television prior to the experiment. They had frequently presented the instruction in the classroom prior to the experiment. The first fact means the instructors had to learn new habits of teaching. The second fact suggests the likelihood of habit interference. Thus, the instructors had to break old habits when instructing over TV and develop new habits. These conditions would most likely reduce the effectiveness of the television instruction.

RETENTION

The results of this experiment are consistent with those of a previous study (7) in indicating that material taught over TV is retained as well as material taught in the regular instruction situation. This result is important in that performance on the job will be more directly related to the retention of instruction than the immediate learning of instruction.

The fact that there was no significant difference between methods of instruction in the retention scores of trainees reduces the importance of the initial differences in learning.

CONCLUSIONS

This study represents a pioneer attempt to present a relatively large segment of an electronics training program by television. The presentation may be characterized as "minimal" television in that little attempt was made to translate the instruction as regularly presented in the classroom into an effective educational television presentation. On the basis of the test results, the following conclusions can be drawn:

1. Television can be employed as a teaching medium intensively (at least for one week) without the day-to-day losses in teaching effectiveness exceeding to any great extent those normally obtained with regular instruction.

2. "Minimal" television presentations similar to the kind presented in this study are not as effective as regular classroom instruction in terms of immediate learning.

3. "Minimal" television instruction is remembered as well as regular classroom instruction.

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*See Appendix I for a discussion of the advantages and disadvantages of "Minimal" television presentations.

Appendix A

NOTES ON THE EXPERIMENTAL DESIGN

The evaluation of the differential effects of "intensive" exposure to television and regular instruction on teaching effectiveness presents a rather difficult problem in terms of experimental design. The inclusion of the controls that would be required to obtain a high degree of sensitivity and to eliminate the confounding influence of non-pertinent variables would result in a highly complex design which would be extremely costly to administer properly.

Only large differences in the effects of "intensive" exposure would be of any great importance. Therefore, a design with a low degree of sensitivity can be employed. It will be recalled that evidence supporting the proposition that "intensive" exposure affects television instruction differently than regular instruction will be in the form of a systematic change in the size of the differences between the two methods of instruction. The differences between test means will also be a function of the content of the instruction and the tests. Thus the possibility of an interaction between media and content of instruction and tests also exists. The effect of this interaction would be to increase the error factor and reduce the possibility of obtaining a systematic trend.

If the content of the instruction were highly interdependent, i.e., if mastery of the content from the second half of the course were dependent upon the mastery of the content from the first half of the course, the initial differences would be compounded. This condition might result in a systematic trend. Such a possibility, however, would require consideration only in the event that a systematic trend were obtained consistent with the direction of the initial differences.

Appendix B

EXAMPLES OF PICTORIAL AND VERBAL TEST ITEMS AS EMPLOYED IN THE STUDY

1. In Figure 1, the control at A is

   A. the coarse adjustment switch.
   B. the fine adjustment switch.
   C. the circuit breaker.
   D. the spare fuse box.

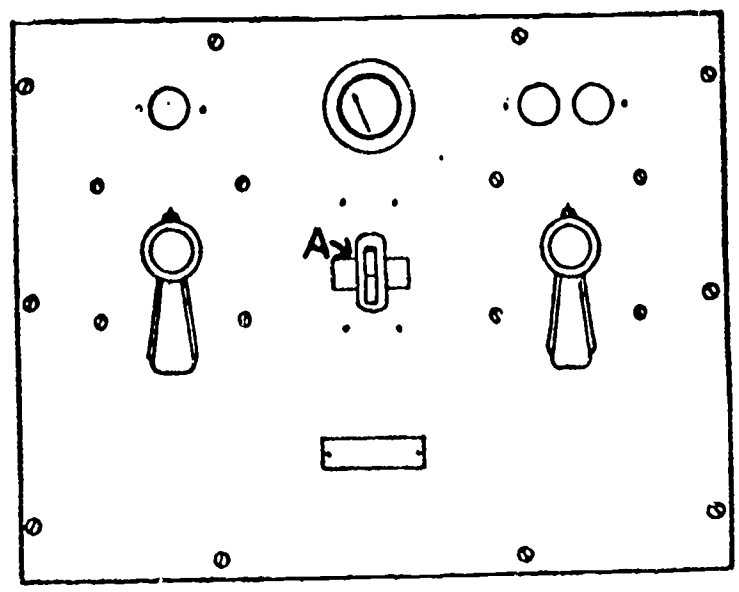
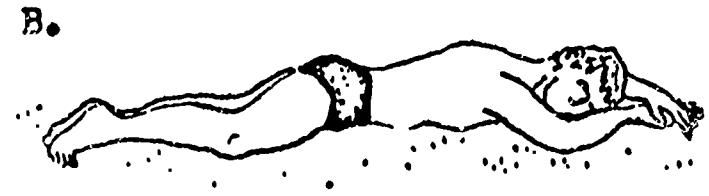


Fig 1

2. In what position would the victim be placed for the chest-pressure method of artificial respiration?

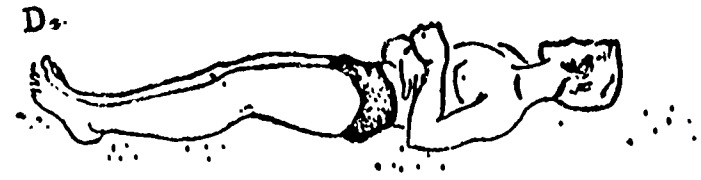
A.

B.



C.

D.



3. To reduce hysteresis

   A. cores are laminated.
   B. cores are made of soft silicon steel.
   C. wires are made of copper.
   D. wires are made of nichrome.

4. When the like terminal of two batteries are connected together the batteries are connected in

A. series.
B. parallel.
C. series-parallel.
D. banks.

5. In Figure 5, voltage in branch A equals

A. 40 V.
B. 4 V.
C. 2 V.
D. 20 V.

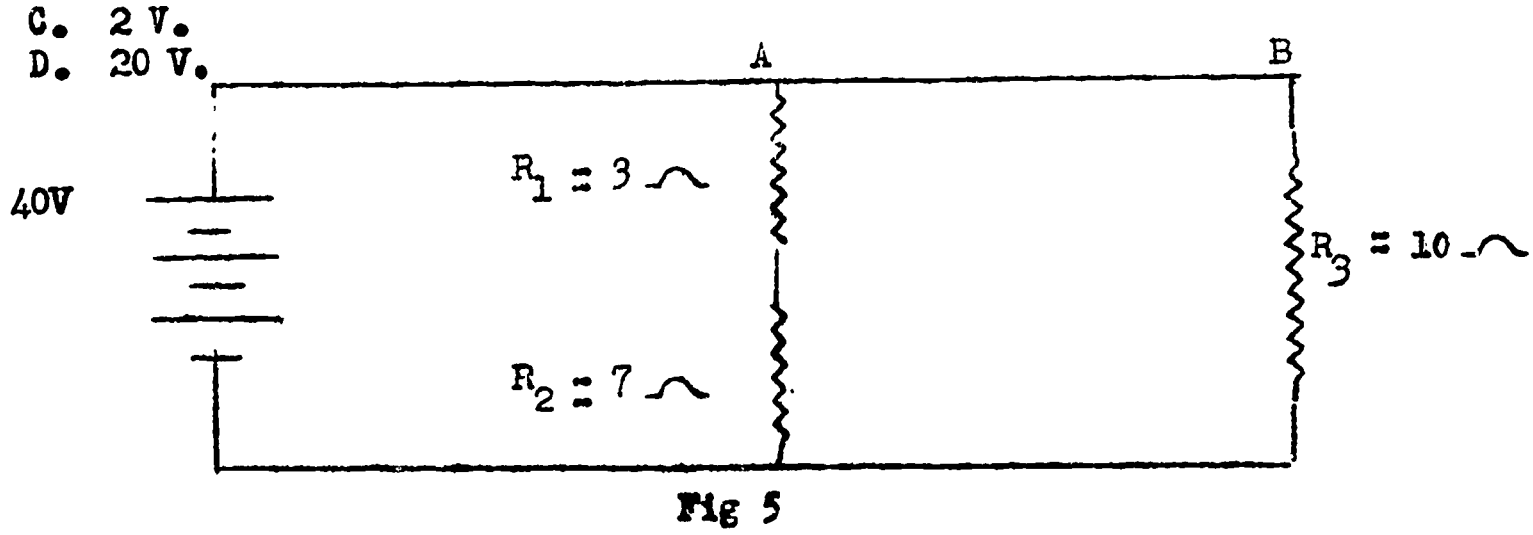


Fig 5

6. Other things being equal, reducing applied voltage in a circuit by one half causes

A. current to double.
B. no change in current.
C. resistance to drop by one half.
D. current to drop by one half.

Appendix C

INSTRUCTION SCHEDULE

Period	Time		DAY Wednesday	Thursday	Friday	Monday	Tuesday
		Lecturer	A	B	C	D	B
1	0710	Subject	First-Aid	Multimeter	Ohm's Law	Review	Transformer Connections
	0753	Format	Conference-Demonstration	Conference-Demonstration	Conference-Demonstration	Conference	Conference-Demonstration
2		Lecturer	B	C	A	B	C
	0803	Subject	Magnetism	Use of Test Equipment	Problems	Grounds	Transformer-Connections
	0846	Format	Conference	Practical Exercise	Practical Exercise	Conference	Practical Exercise
3		Lecturer	C	A	B	C	A
	0856	Subject	Electricity & Magnetism	Principles of Series Circuits	Application	Installation of Grounds	Storage Batteries
	0939	Format	Conference Training Film	Conference	Practical Exercise	Conference	Conference
4		Lecturer	D	D	D	B	D
	0949	Subject	Magnets	Ohm's Law	Application	Electro-Magnetism	Battery Connections
	1032	Format	Conference	Conference	Practical Exercise	Conference	Conference

APPENDIX C (Contd)

INSTRUCTION SCHEDULE

Period	Time	DAY Wednesday	Thursday	Friday	Monday	Tuesday
	Lecturer	B	B			
	1042 Subject	Principles of Magnetism	Ohm's Law	Diagrams	Induction	RA-91 Rectifier
	1125 Format	Conference	Training Film Demonstration	Conference	Conference	Conference
TEST	1124-1200					
	Lecturer	C	A	C	C	C
6	1325 Subject	Magnetic Fields	Problem Solving	Diagram Reading	Types of Induction	Operation of Rectifier
	1408 Format	Conference	Practical Exercise	Conference-Demonstration	Conference-Demonstration	Training Films
	Lecturer	D	D	D	D	D
7	1418 Subject	Meters	Application	Tracing Circuits	Fundamentals of Transformers	Records
	1501 Format	Conference-Demonstration	Practical Exercise	Practical Exercise	Conference	Conference-Demonstration
	Lecturer		C		A	B
8	1511 Subject	TESTED 1501-1520	Parallel Circuits	TESTED 1501-1520	Types of Transformers	Preparation for Battery Charging
	1554 Format		Conference		Conference-Demonstration	Practical Exercise
TEST	1554-1620	No Test		No Test		

Appendix D

POST SELECTION AND POST MATCHING OF TRAINEES

Of the 281 trainees taking part in the experiment, 58 were washbacks, and no information concerning aptitude test scores was available for 22. Another 59 trainees did not complete the 10 tests. Of the remaining 142, 78 were in the regular instruction group, and 64 were in the TV instruction. In the process of post-experimental matching of subjects for aptitude, another 18 trainees were dropped, leaving a final sample of 62 trainees in each group.

The post-matching procedure was introduced to eliminate the possible confounding effect of differences in aptitude. It also served to increase the precision of the experiment. A single measure of aptitude was obtained by first ranking the 142 trainees completing the 10 tests in terms of their RV, AR, PA, and EI scores, and then determining the average rank for each trainee. The ranking measure was employed because the EI distribution had an artificial cut-off point. Trainees with equivalent average ranks were then paired off, resulting in the final 62 pairs.

The analysis of the retention data is based on a sample of 50 pairs of trainees. Of the 62 pairs of trainees used in the analysis of the learning data, 12 had to be dropped because of washbacks repeating the course and trainees failing to take the retention test.

Appendix E

OVERALL ANALYSIS OF VARIANCE: IMMEDIATE TEST*

Source	df	MS	F	Significance Level
Aptitude	1	210.08	36.74	0.1%
Error (b) - (aptitude)	60	5.72	-	
Medium	1	37.73	17.87	0.1%
Tests	9	.03	.06	-
Medium x Tests	9	1.05	2.22	2.5%
Medium x Aptitude	1	.27	.13	-
Aptitude x Tests	9	1.06	2.38	2.5%
Tests x Medium x Aptitude	9	.36	.76	-
$error_1$ (w) (medium, medium x aptitude)	60	2.11	-	
$error_2$ (w) (test, text x aptitude)	540	.44	-	
$error_3$ (w) (medium x test, medium x test x aptitude)	540	.47	-	

*In order to equate for test difficulty and test variances, all test scores were transformed into standard scores by using the overall test X's and variances in the Z score formula $\frac{x}{\sigma}$. The one deficiency in this procedure is that it doesn't eliminate differences in the distribution of test scores. See (9, pp267-273) for discussion of the design.

Appendix F

ANALYSES OF VARIANCE FOR THE TEN TESTS

Test Source	df	1 ms	1 F	2 ms	2 F	3 ms	3 F	4 ms	4 F	5 ms	5 F
Between Aptitude	1	30.77	44.66*	18.60	16.71*	34.77	37.88*	14.19	10.80*	26.18	26.10*
error (b)	60	.69	-	1.11	-	.92	-	1.31	-	1.00	-
Between Media	1	9.78	20.33*	5.19	11.10*	5.47	11.66*	.65	1	.80	1.36
Interaction	1	1.57	3.27	.01	1	.18	1	.08	1	1.11	1.90
error (w)	60	.48	-	.47	-	.47	-	.72	-	.59	

Test (Cont'd) Source	df	6 ms	6 F	7 ms	7 F	8 ms	8 F	9 ms	9 F	10 ms	10 F
Between Aptitude	1	10.74	9.51*	26.77	38.02*	8.13	8.17*	29.75	34.15*	19.69	20.21*
error (b)	60	1.14	-	.70	-	1.00	-	.87	-	.97	-
Between Media	1	1.73	2.37	3.58	4.26*	1.10	1.21	6.36	10.80*	17.90	70.77*
Interaction	1	.34	1	.10	1	.00	1	.03	1	.06	1
error (w)	60	.73	-	.84	-	.92	-	.59	-	.25	-

* F at the 5% level of confidence (df - 1, 60) is 4.00.

Appendix G

ANALYSIS OF VARIANCE OF LEARNING AND RETENTION SCORES ON THE 70-ITEM RETENTION TEST**

Administration		Learning		Retention	
Source	df	ms	F	ms	F
Between Aptitude Level	1	3274.30	29.15*	1795.23	17.34*
error (b)	48	112.32	-	103.56	-
Between Media	1	552.25	7.77*	108.16	1.72
Interaction	1	.07	1	27.93	1
error (w)	48	71.09	-	62.79	-

* F at the 5% level of confidence (df - 1, 40) is 4.08

**See (9, pp 267-273) for discussion of the design.

Appendix H

FURTHER DISCUSSION OF DIFFERENTIAL DECREASE RESULTS

In this section, we are concerned with determining whether or not there is any evidence for systematic change in the size of the difference between regular instruction and TV instruction as a function of the temporal sequence of the tests.

The significant interaction between medium and test in the overall analysis of variance (see Appendix E) indicates that there are changes in the size of the differences, but it doesn't indicate whether the changes are systematic. The rank order correlation between column 1 and column 2 of Table 6 is .24 (Spearman's rho), which is not a very high correlation. The largest and smallest per cent difference is test 10 and test 5 respectively. The difference between these two is 9.0%. The means of the % differences between the means of the two media for the first five and the last five tests were 4.5 and 6.2. Wilcoxon's test for unpaired replicates (15) was applied and the difference was found to be insignificant.

Due to the inability to control for differences in tests and the instruction upon which the tests are based, no conclusion can be drawn with any degree of confidence as to the presence or absence of differential decrement. However, it is possible to draw a very rough estimate of the limits of the differential decrement factor. One way is to determine the slope of the best-fitting straight line. This procedure is open to the criticism that the arbitrary assumption of linearity of regression is made. With this reservation in mind we will present the results obtained with the method of least squares (4, pp.63-65). The formula for the best-fitting straight line of the test differences was $Y' = .36X + 3.37$. The slope was .36 which does not differ significantly from a slope of zero (see 14, pg 241 for test of significance of slope). Figure 9 presents the obtained differences and the best-fitting straight line. It can be seen from this figure that the straight line does not match the obtained differences very well. The slope indicates an average increase of 0.36% in the size of the differences with each succeeding test.

Interpretation of the differential decrement results must be in terms of the overall differences favoring regular instruction. This difference which was found even in the first test represents a limiting factor as to the generality of the conclusions obtained concerning differential decrement. That is, the nature of the differential decrement factor might have been changed if the TV groups test performance either equalled or was superior to the test performance of the regular instruction group. In cases where the learning of later material is dependent upon the learning of prior material, any discrepancy between groups in the learning of the earlier material will be compounded in the learning of the later material. Therefore, we must recognize the limitations placed upon the interpretation of the differential decrement results by the overall difference.

Interpretation of the differential decrement results is further limited by the failure to control for instruction and test content. Thus, it would be impossible to draw any definitive conclusions from these results as to the presence or absence of differential decrement. There is, however, a good case for stating that the differential decrement factor, if existent, is not exceedingly large, and it should have appeared despite variations in instruction and test content. Since it did not, we can assume it to be, at best, relatively small.

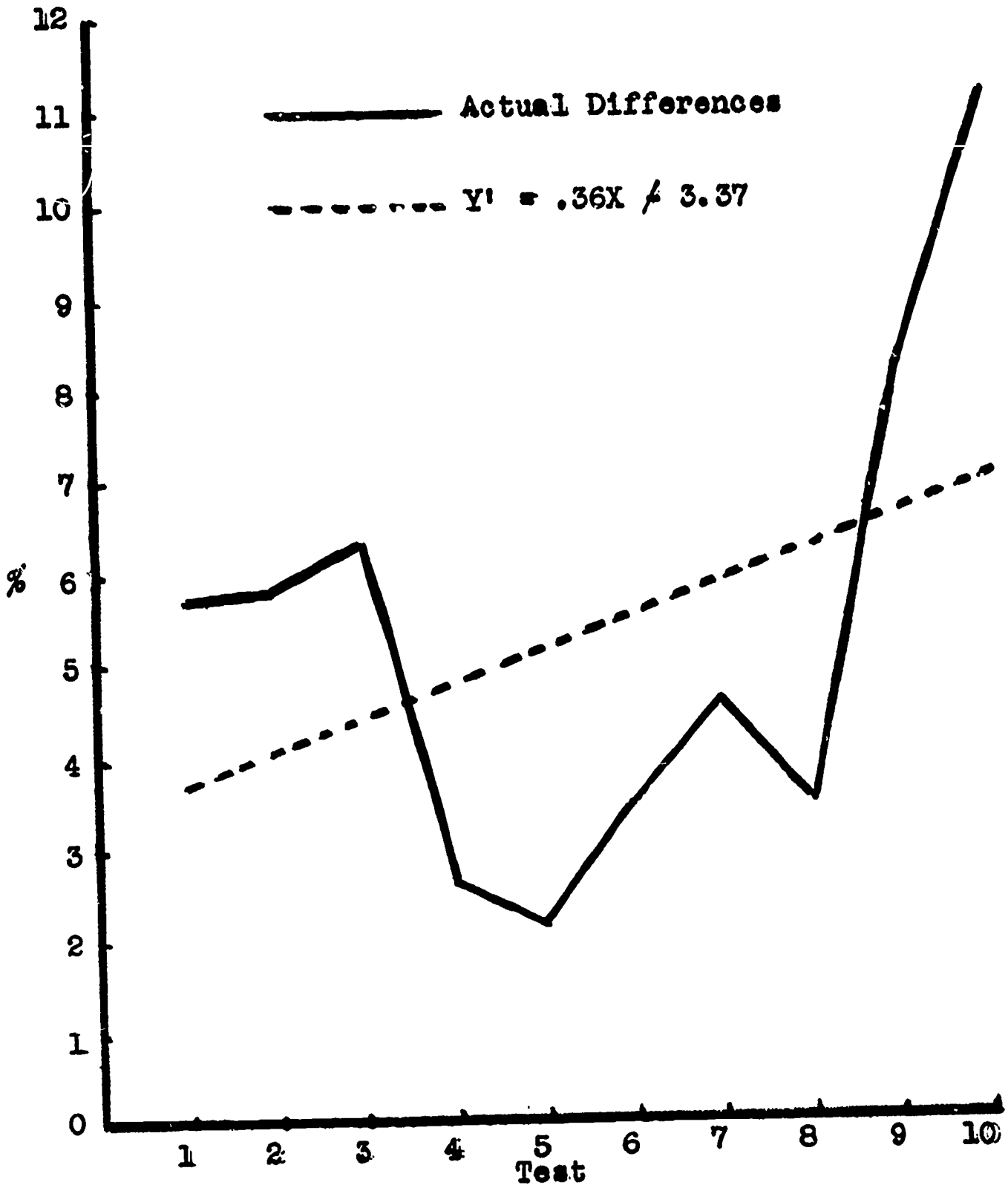


Figure 9. Best-fitting straight line of differences between media on the ten tests.

Appendix I

THE USE OF "MINIMAL" TELEVISION

"Minimal" television as employed in this study refers to the procedure of transmitting existing classroom instruction over television with little or no adaptation of the material to television techniques, e.g., closeups, split-screen, superimposures, participation, etc. As a method of television teaching, it is probably the predominant form in many areas of military and civilian instruction. From the experience and results of this study, the method has the following advantages:

1. For practical purposes, learning from "minimal" television approximates that obtained in the classroom. From a retention viewpoint there were no differences, one month later, between television and classroom instruction.

2. It is a relatively inexpensive method of television teaching, since it employs existing materials and instructional personnel.

3. During periods of emergency or mobilization, the rapid transition to television dissemination may prove valuable in terms of time savings and costs.

The disadvantages of "minimal" television procedures are:

1. Teaching effectiveness is limited to that of the original classroom or other instruction upon which the television presentation is based.

2. Boredom and low motivation inherent in the original instruction may even increase in television transmission.

3. Difficult classroom teaching problems, which such television techniques as closeups, superimposures, split-screen might solve, cannot be facilitated by "minimal" television.

4. The instruction is focused upon and dominated by the instructor rather than upon critical learning aspects and the lack of participation places the students in a passive learning role.

5. New instructors watching a "minimal" television presentation are dependent upon the skills which the television instructor possessed in the classroom rather than any improvements or changes brought about by adapting and using television teaching techniques.

6. Experienced classroom instructors will miss the cues and "feedback" provided by students when teaching over television. Their pacing and teaching skills probably are disrupted.

7. From a production viewpoint, lack of scripts hinders the planning and timing of "minimal" television presentations by the director and other television personnel.

During emergency or mobilization periods, "minimal" television presentations can provide, under certain conditions, a low cost, rapid method of instruction and information. For installations just acquiring television facilities, "minimal" television methods can provide immediate experience in the use of television for instruction as well as meet many pressing training problems. An example would be the training of large groups when only a few qualified instructors are available. However, this utilization phase should be gradually superseded by efforts to incorporate the advantages of television into military training. These efforts would include reorganization of instructional material so as to improve teaching effectiveness, reduce training time and improve instructor training along the lines described in previous studies (2). Testing of television program effectiveness, use of prepared scripts and the employment of 'special effects" would be part of this more effective employment of television training. The use of prompting equipment would be important and would achieve a standardization of effective television teaching not possible in "minimal" television presentations.

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